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NSTX Project Status and Plan

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Los Alamos
NATIONAL LABORATORY



ornl



UCLA



UW

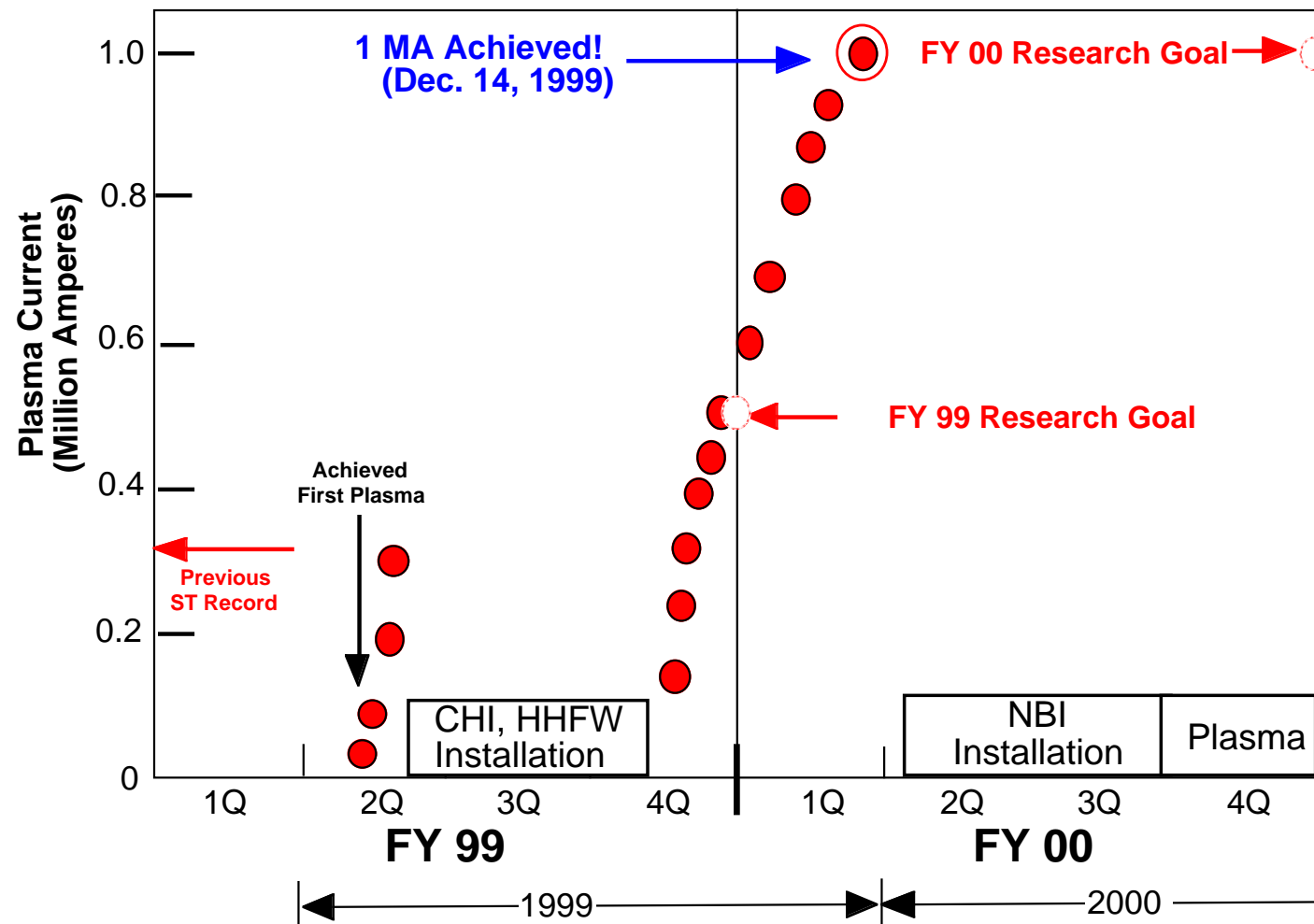


OFES Budget Planning Meeting
April 5, 2000

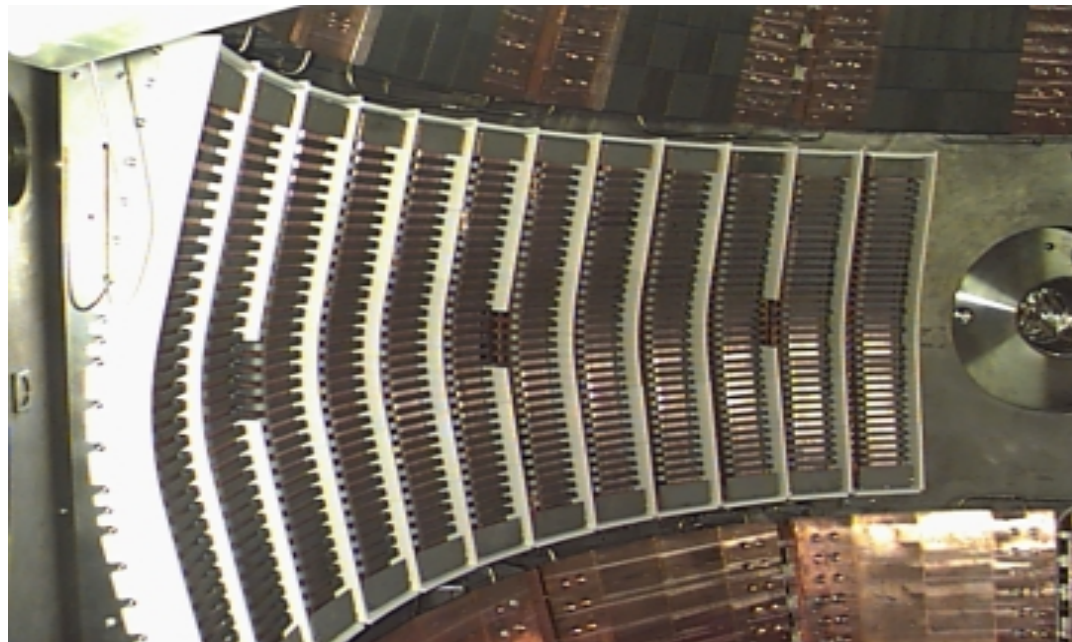
One Million Amperes Achieved on NSTX!



NSTX



High Harmonic Fast Wave Plan



Enabling Technology
PPPL-ORNL Collaboration

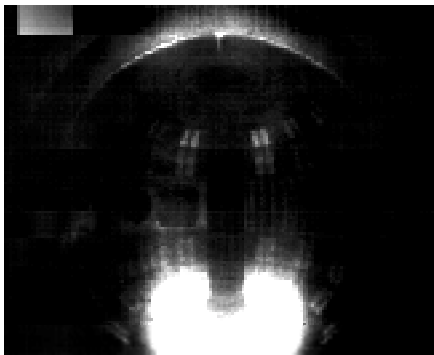
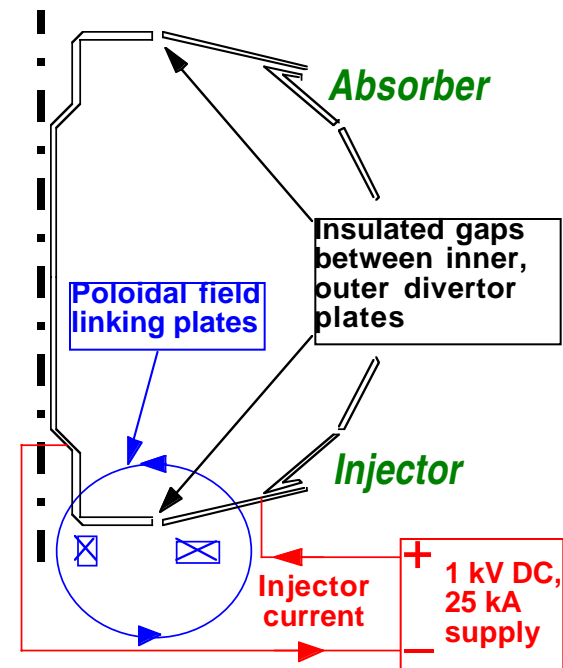
HHFW Physics Team includes
PPPL, ORNL, GA, UCSD, MIT

- Achieved 2 MW. Observed plasma loading agrees with calculated value using ORNL reflectometry edge density profile. Core electron heating observed.
- Full 12 antenna – 6 transmitter real-time-phasing configuration implemented for the next run. 4MW in FY 00 and 6 MW in FY01

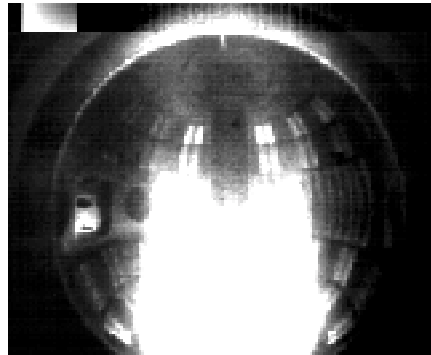
Coaxial Helicity Injection Status



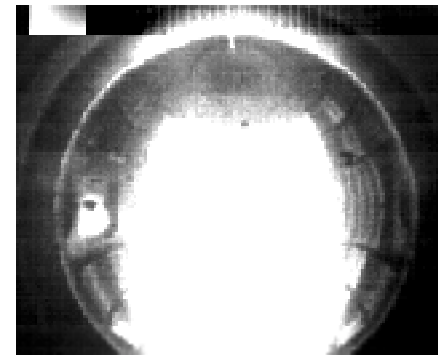
- Simplify ST design by eliminating central solenoid
 - 130 kA, 100 msec discharges obtained with 20 kA injection
 - Very good synergy with HIT-II
 - 50 kA injection for next run
 - Aim for 0.5MA capability in NSTX



t = 16ms



t = 18ms

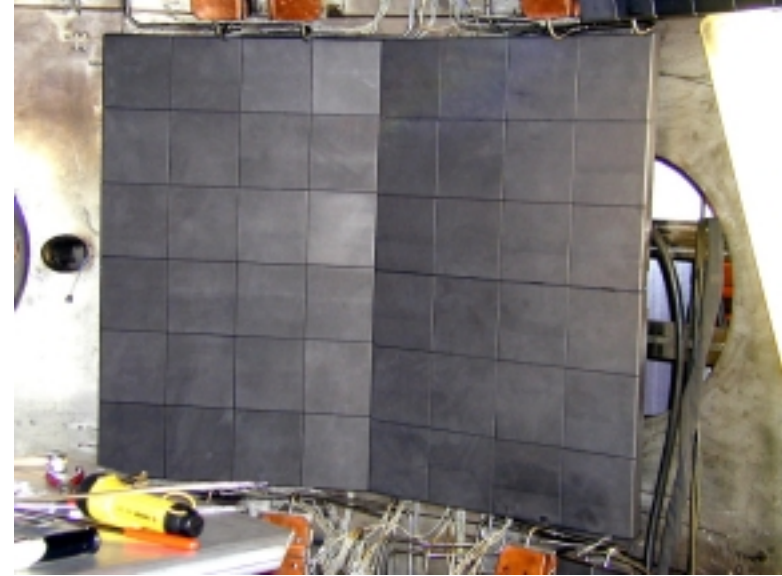


t = 20ms

NBI INSTALLATION MAKING EXCELLENT PROGRESS



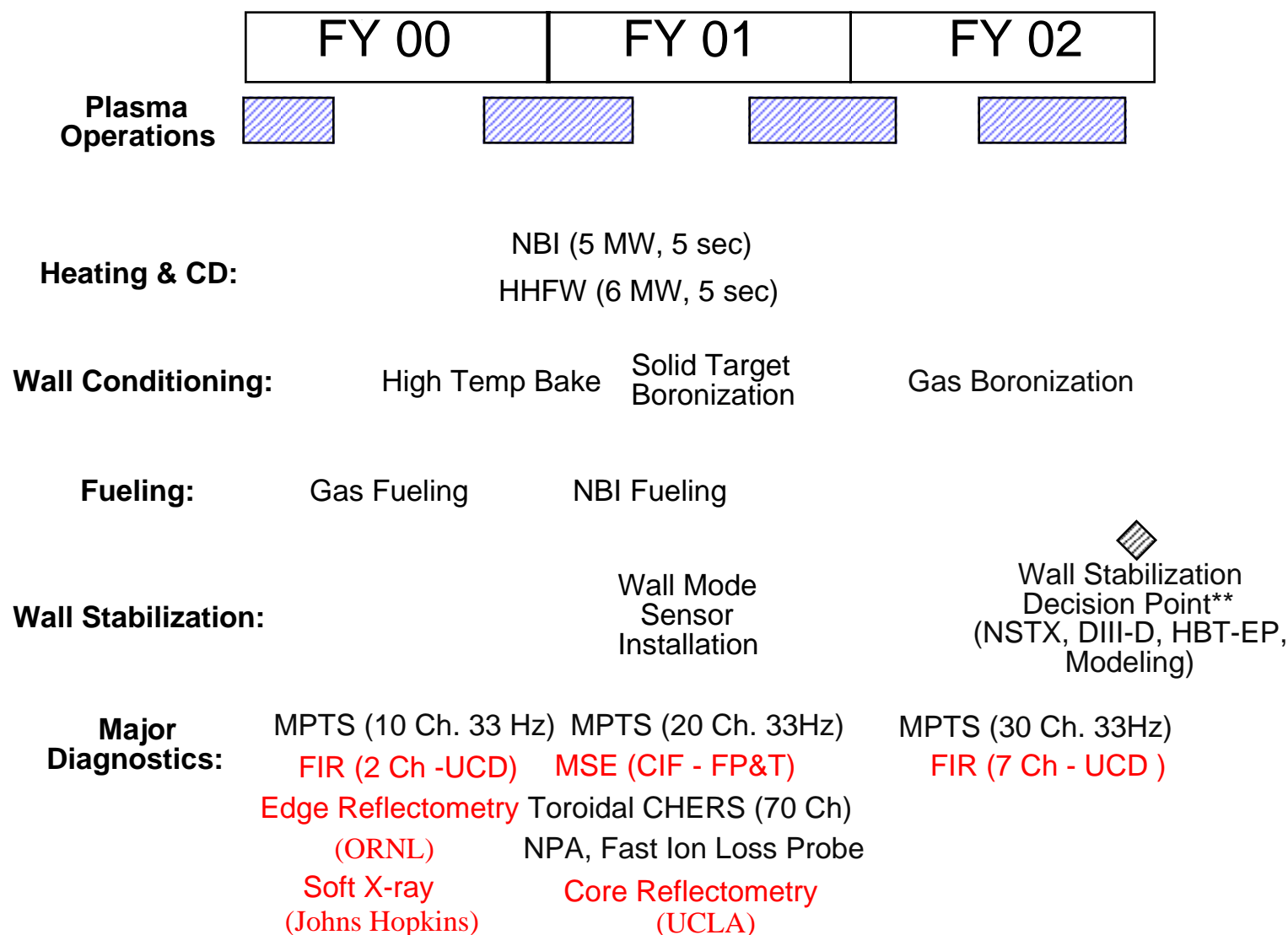
NBI under construction



NBI protective armor inside NSTX

- Vacuum system pump down in July; Conditioning in Aug. – Sept.
- Injection into plasma in Oct. 2000.
- 70 Channel CHERS system in Oct. 2000 and MSE in May 2001.

FY 00- 02 Base Budget Facility Plan



Incremental Request to meet FESAC Goals



- Increase run week from 13 to 19 weeks per year.
- Enhance profile diagnostic capabilities for local transport studies.
 - Increase in spatial and temporal resolution for MP Thomson System.
 - Complete Poloidal CHERS in FY 02.
 - Start fluctuation and LIF-MSE (Er) diagnostics work on FY 02.
- Enhance research support for increased runs and diagnostics.
- Diborane Boronization System in FY 01 instead of FY 02
 - Diborane is a proven impurity control for high power operations
- Enhance collaboration research support and enhance advanced diagnostics (e.g., Edge/Divertor Probes, LIF-MSE and Fluctuation Diagnostics)

Achieve FY 03 science milestones in FY 02

Critical Upgrades to Support FESAC 5-10 Year Objectives



- ECH/EBW upgrade to achieve rf-only non-inductive start-up method.
(ORNL/PPPL Joint Project)
 - EBW may be used to access higher density plasma core.
 - ECH/EBW ST formation + HHFW (6MW) heating and CD could lead to an rf-only non-inductive current start-up method.
 - Proposed plan:
 - Establish ECH/EBW physics feasibility in FY 01 (\$ 0.05 M incremental).
 - Engineering design and costing in FY 02 (\$ 0.2 M incremental)
- Center Stack upgrade to achieve FESAC 5-10 year objectives.
 - Demonstrate attractiveness of ST for the pulse duration $\tau \gg \tau_{\text{skin}}$.
 - Determine BP, VNS readiness in 10 years to test $k \Rightarrow 3$ regime.
 - Test Aries-ST-like ultra high bootstrap current reactor concept.
- Main Capabilities: Longer pulse, higher plasma current, and higher toroidal field with improved CHI and PFC design
- Proposed Plan:
 - Scoping Study in FY 01 (\$0.14M incremental)
 - Eng. design and costing in FY 02 (\$0.8 M incremental)

NSTX Budget Summary (\$M)



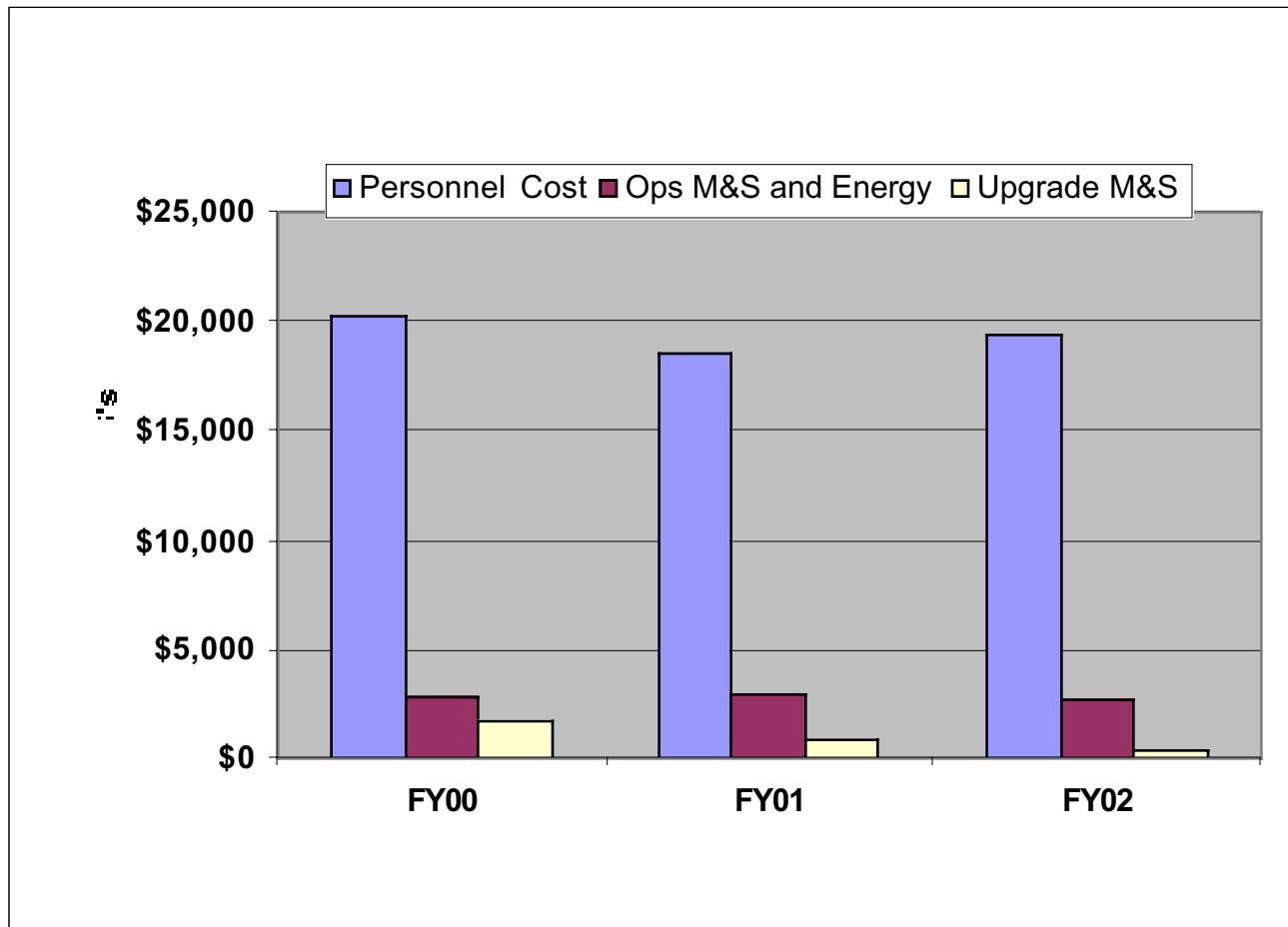
	FY 00	FY 01		FY 02	
Facility (RUN WEEKS)		Base	Inc.	Base	Inc.
	(14)	(13)	(6)	(13)	(6)
Facility Op.	12.91	11.80	1.71	11.89	1.1
NBI Op.		2.06		2.24	
NBI Const.	2.5				
ECH Upgrade			0.05		0.2
CS Upgrade			0.14		0.8
Facility Total	15.41	13.86	1.90	14.13	2.1

Science					
PPPL Research	6.43	6.25	0.35	6.78	0.50
PPPL Diag.	1.62	1.60	0.88	0.96	0.8
Diag. Interface*	0.5	0.53	0.07	0.38	0.15
PPPL Sci. Total	8.55	8.38	1.30	8.12	1.45
Collaboration	4.3	4.48	0.305	4.48	0.305

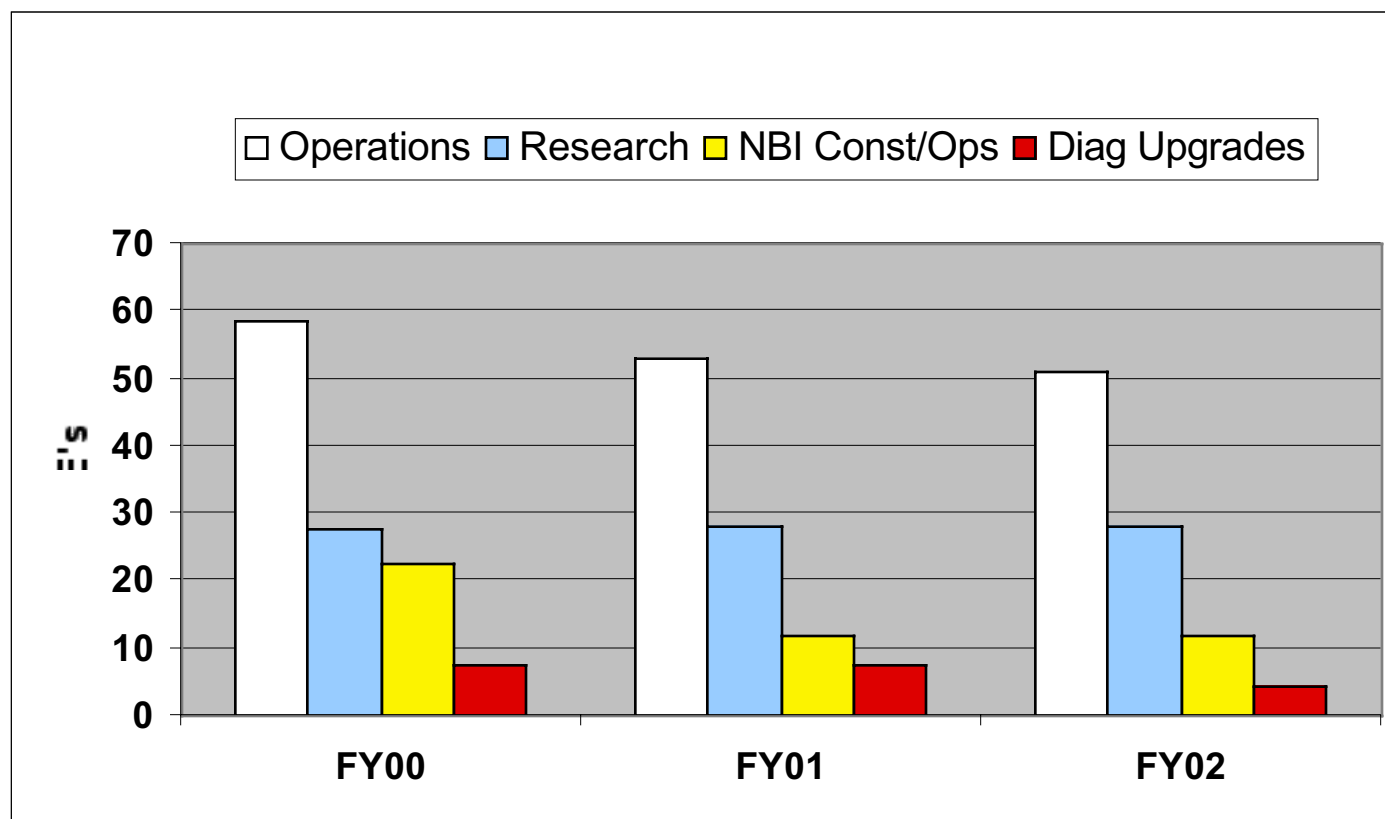
Grand Total	28.26	26.72	3.5	26.73	3.86
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*For collaboration diagnostics only

NSTX Budget goes mostly to Personnel



NSTX PPPL Personnel Staffing



FACILITY UTILIZATION



Facility Plasma Operations Availability

	FY 99	FY 00	FY 01	FY 02
# of run weeks	5*	14 (10*)	13	13
# of hours	110*	560 (420*)	520	520

* actual to date

Research Personnel

	PPPL	non-PPPL
Researchers	49	48
Grad. Students	6	6

VISITING SCIENTISTS

Visiting US Scientists	20
Visiting Foreign Scientists	20

IMPACT OF 10% BUDGET REDUCTION



- Roughly equal reduction in three areas: 1/3 in runs (from 13 to 9 weeks), 1/3 in diagnostic upgrades, and 1/3 in science/operations
- NSTX staff reduction of $\cong 10\%$ or $\cong 10$ FTEs.
- M&S reduction of $\cong 10\%$ (upgrade diagnostic components, spare parts, energy, travel, etc.)
- Critical diagnostics and ECH upgrades not implemented: NPA and MPTS.
- Only 2/3 of experimental runs carried out or 4 month slip of program schedule in addition to adverse impacts on longer range research.

FACILITY UTILIZATION



- NSTX Team has achieved major milestones on budget and on schedule.
- Facility achieved high level of availability and utilization in first 12 month of operation.
- New tools (NBI and MPTS) are being installed.
- FY 01-02 base budget allows 13 run weeks.
- Incremental funding needed to meet the FESAC goals.